goes to the trouble of discussing quantum mechanical axioms in connection with statistical assemblies of systems. Clearly, if theorems like that of related indeterminacies are to have meaning in terms of measurements at all, they must be applied to large collections of similar systems. The material presented in relation to this matter is of course largely that published in the author's earlier papers and includes his treatment of thermodynamics. On the whole, the book is probably the most complete and rigorous discussion of the subject indicated by its title.

Naturally, no book is free from minor defects, and no review is complete without their exposition. We feel that von Neumann's book could have been improved by adding an alphabetical index. It also contains no foot-notes. All notes are collected in the appendix, and it happens occasionally that the reader, already disconcerted by having to turn many pages in order to find a reference given in the text, is referred again to a previous note to secure an insignificant bit of information.

HENRY MARGENAU

Wave Mechanics. Elementary Theory. By J. Frenkel. Oxford, Clarendon Press, 1932. viii+278 pp. $5.00.

This is one of the international series of monographs on physics edited by Fowler and Kapitza. Planned originally as a translation of the author's relatively brief *Einführung in die Wellenmechanik*, the text has been so expanded in revision that the completed work is expected to consist of three volumes, of which this is the first. The second is already in press, and the third is planned for next year.

The present volume is intended to give a general survey of the whole subject, using only elementary mathematics. The approach is from the physical rather than from the mathematical point of view, and the author succeeds in covering a vast amount of material. Starting with a brief historical survey of the corpuscular and wave theories of light and a glance at the relativity theory, he discusses the extension of the dual particle-and-wave concept to matter, and leads up to the wave mechanics through Heisenberg's uncertainty relation. A chapter on the wave mechanics of the motion of a particle in a field of force, in which considerable emphasis is laid on the properties of potential barriers, is followed by one on the wave mechanics of a system of particles. Next comes a chapter on statistical mechanics, in which the Einstein-Bose and Fermi-Dirac statistics are contrasted with the classical theory, and the book closes with a chapter on the application of the quantum statistics to the electron theory of metals, heat motion, and radiation. In this last chapter, the author adds to the familiar electron, proton, and photon a new particle, the phonon.

The author's comments and discussion, rendered in a most vivid style, are very illuminating and form the most valuable feature of the book. On the other hand, the book lacks the beautifully logical development of the subject exhibited in de Broglie's *Théorie de la Quantification*, and the reader, unless he already possesses an expert knowledge of the subject, is likely to emerge a trifle bewildered by the complexity and range of the material covered.

LEIGH PAGE